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VERIFICATION OF TRANSLATION

I, Michaela Komine, translator of 1-817 Amaike-cho, Mibu, Nakagyo-ku, Kyoto-shi, Japan, hereby declare that I am conversant with the English and Japanese languages and am a competent translator thereof. I further declare that to the best of my knowledge and belief the following is a true and correct translation made by me of Japanese Unexamined Utility Model Publication No. 57-131016 filed on February 9, 1981.

Date: September 26, 2005

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JAPANESE UNEXAMINED UTILITY MODEL APPLICATION PUBLICATION NO.
57-131016
TITLE: BI-DIRECTIONAL AMPLIFIER
FILING DATE: February 9, 1981
PUBLICATION DATE: August 16, 1982

Description

1. Title of the Device BI-DIRECTIONAL AMPLIFIER

2. Claim

A bi-directional amplifier characterized by being composed of: a first transistor of which an intermediate tag of a secondary winding is grounded via a capacitor, an end of a primary winding is used as an input/output common terminal and another end of the primary winding is grounded; a second transistor having the same structure as the first transistor; a first FET of which a source electrode is connected to one end of the secondary winding of the first transistor, a drain electrode is connected to one end of the secondary winding of the second transistor, and a gate electrode is grounded; a second FET of which a source electrode is connected to the other end of the secondary winding of the first transistor, a drain electrode is connected to the other end of the secondary winding of the second transistor, and a gate electrode is grounded; and a power source that is connected between the intermediate tag of the secondary winding of the first transistor and the intermediate tag of the secondary winding of the second transistor and is capable of reversing polarity thereof.

3. Detailed Description of the Device

The present device relates to a bi-directional amplifier that has two input/output common terminals, and that is able to perform amplification operations in either direction between the two terminals.

Conventionally, as in a transmission audio modulator and a reception audio amplifier in a transceiver, or a recoding amplifier and a playback amplifier in a tape recorder, when two amplifiers exist that have differing usage purposes and exclusive usage times but the same operations as circuit components, a structure is generally used that uses a switch circuit to switch one common amplifier, in order to improve compactness and performance, and to lower cost.

FIG. 1 is an example of one such amplifier. When a coupled switch S11 is switched towards the upper side in the drawing, a signal is input from an input terminal I-a into an amplifier G11 and amplified, and then output from an output terminal O-b.

On the other hand, when the coupled switch S11 is switched towards the lower side in the drawing, a signal is input from an input terminal I-b into the amplifier G11 and amplified, and then output from an output terminal O-a. When this circuit is used in a transceiver, for example, it is suitable to connect a microphone to the input terminal I-a, a receiver demodulation output terminal to the input terminal I-b, a speaker to the output terminal O-a, and couple the coupled switch S11 with the transmission/reception switcher of the transceiver. This circuit is characterized by being able to perform dual-series unidirectional amplification operations according to the switching of the coupled switch S11, specifically, I-a → O-b and I-b → O-a.

FIG. 2 shows an amplifier of the stated structure, taken one step further. The amplifier is provided with input/output common terminals I/O-a and I/O-b, and by connecting these to an amplifier G12 with forward and reverse reversed according to a coupled switch S12, the signal amplification direction can be selected to be either I/O-a → I/O-b or I/O-b → I/O-a. When this circuit is used in a tape recorder, for example, a microphone/speaker is connected to the input/output common terminal I/O-a and a recording/playback head is attached to the input/output common terminal I/O-b. The coupled switch S12 is coupled with the recording/playback switcher of the transceiver.

In this way, this circuit is characterized by being able to perform single series bi-directional modulation operations.

However, both of the amplifiers described above use, as the switch, a mechanical contact-type switch or an electronic-type switch that uses a diode or the like. Therefore, in the case of the former type, due to the contact resistor at the contact point, there are problems such as loss and instability, and generation of noise when switching. Furthermore, in the case of the latter type, there are problems such as non-linear distortion being generated by the diode or the like when a large signal passes through, or a capacitor, which is inserted in the signal path to prevent a switching-use DC signal from flowing into the amplifier, causing phase distortion in the signal. Due to these problems, obtaining a superior quality signal was extremely difficult.

An object of the present device is to provide a bi-directional amplifier that solves conventional problems such as the above-described, and in which a switching circuit is not directly inserted in the signal path.

The following describes an implementation example of the present device based on FIG. 3.

In the drawing, T1 and T2 are transistors that have an intermediate tab in a secondary winding, Q1 and Q2 are FETs whose source electrode and drain electrode are interchangeable, C1 and C2 are capacitors, Q3 to Q6 are switching transistors, R is a resistor, S is a switching signal input terminal, Vcc is the power source, and I/O-A and I/O-B are input/output common terminals. The device has the structure shown in the drawing.

In the described structure, upon applying an "H" (high level) signal to the switching signal input terminal S, the transistors Q3 and Q5 turn on. Therefore, the voltage of the power supply Vcc is given to the secondary winding intermediate tab of the transistor T2, and the secondary winding intermediate tab of the transistor T1 is in a grounded state. Consequently, the signal amplifier direction is the direction I/O-A → I/O-B. Note that the internal resistor of the transistor Q3 that is on at this time acts as the source resistor of the FETs Q1 and Q2.

Conversely, upon applying an "L" (low level) signal to the switching signal input terminal S, the transistors Q4 and Q6 turn on. Therefore, the voltage of the power supply Vcc is given to the secondary winding intermediate tab of the transistor T1, and secondary winding intermediate tab of the transistor T2 is in a grounded state. Here, because the FETs Q1 and Q2 have interchangeable source and drain electrodes, the internal resistor in the transistor Q6 that is on acts as a "source" resistor with respect to the drain electrode of both FETs, and therefore the signal amplification direction is the direction

I/O-B → I/O-A.

Note that in the present circuit the reason that the amplifier has a push-pull structure is because when usage frequency bandwidth of the amplifier and the switching speed of the switching signal applied to the switching signal input terminal match, the switching signal does not appear on the output-side.

As has been described, according to the bi-directional amplifier of the present device, because the switching circuit is not directly inserted in the signal path, instability due to contact resistance at the contact point and non-linear distortion due to a switching element are eliminated, and a high-quality amplified signal can be obtained. In addition, for reasons such as an extremely simple structure, and ease of manufacture and low cost, the bi-directional amplifier of the present device has numerous superior features.

4. Brief description of the drawings

FIG. 1 is a circuit diagram of a conventional circuit structure used when dual series unidirectional amplification operations are performed in one amplifier; FIG. 2 is a circuit diagram of a conventional circuit structure when single series unidirectional amplification operations are performed in one amplifier; and FIG. 3 is a circuit diagram showing one implementation example of the bi-directional amplifier relating to the present device.

T1, T2…transistor
C1, C2…capacitor
R…resistor
Vcc…power source
I/O-A, I/O-B…input/output common terminal
Q1, Q2…FET
Q3-Q6…switching transistor
S…switching signal input terminal

FIG. 1

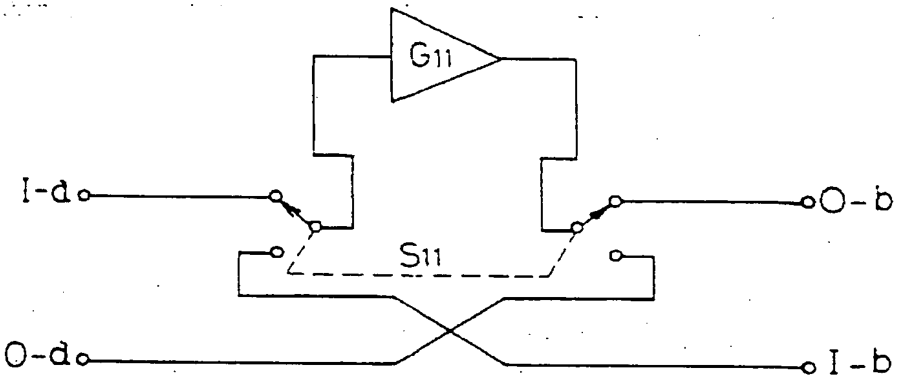

FIG. 2

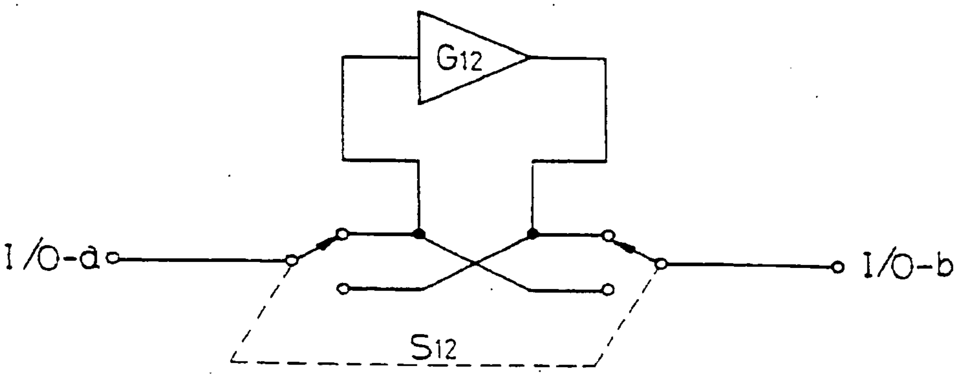

FIG. 3